**SCIENCE AND TECHNOLOGY**

**ALTERNATE MAGNETIC REFRIGERANT**

**Why in News?**

Researchers have found a new alloy that can act as an effective magnetic refrigerant that can be an alternative cooling agent for minimizing greenhouse gas emissions and meet the global demand for higher energy efficiency for tackling global warming.

**What is Alternate Magnetic Magnetic Refrigerant?**

* Magnetic refrigeration offers an **energy-efficient and environment-friendly cooling technology** as an alternative to the vapor-cycle refrigeration technology in use today. Hence efforts are on to fabricate magnetic refrigerators for household, industrial, and technological applications**.**
* Magnetic cooling effect (MCE) is defined as the **reversible temperature change of a magnetic material when it is subjected to an external applied magnetic field.**
* In the magnetic refrigeration cycle, a magnetic field is applied on the magnetic material under an adiabatic process (no exchange of heat with the surrounding).
* Initially randomly oriented magnetic moments get aligned along the external magnetic field, resulting in the heating of the magnetic material.
* This heat is transferred from the material to the ambience. When the magnetic field is removed during adiabatic demagnetization, the magnetic moments of the material become randomized, resulting in a decrease in temperature below the ambient temperature.
* This process causes the material to absorb heat from the surrounding heat-transfer medium.
* Current research is focused on developing **new magnetic materials such as refrigerants.**
* **Three critical criteria need to be fulfilled**. First, the material must be capable of operating for millions of cycles without any fatigue and failure, the material must have high thermal conductivity and the material should respond to external magnetic field of about 2 T (Tesla) which can be generated by permanent magnets**.**
* Since most of the materials developed so far show giant magneto caloric effect (GMCE) only at fields as high as 5 T, there is an urgent need to look for materials in which GMCE is achieved in lower fields**.**
* A team S.N. Bose National Centre for Basic Sciences, an autonomous institute of the department of science and Technology (DST) experimented with a certain type of alloys called all-transition metal based Heusler alloys (magnetic intermetallics with face-centered cubic crystal structure) in their search for material exhibiting giant reversible MCE.
* The team at S.N. Bose Centre has chosen **Ni (Co)-Mn-Ti Heusler system** because such systems often exhibit multifunctional properties with ultrahigh mechanical stability because of their intrinsic d-d hybridization.